

B. SPECIFIC REQUIREMENTS FOR LAND APPLICATION OF WASTEWATER AND SOLIDS**1. Production and Characterization****a. Wastewater**

Wastewater to be land applied is derived from Produced water from recovery trenches 095 and 005; pond 5 and from Raffinate de-watering. It is estimated that that approximately 9,590,000 gallons/year of wastewater will be available for land application.

The following table shows the composition of wastewater samples used to calculate soil loading:

Parameter	095 Trench	005 Trench	Pond 5 (from run off)	Raffinate De-Water
Nitrate Nitrogen (mg/l)	1700	286	379	3490
Ammonia-N (mg/l)	--	--	345 (est)	1620
Volume of Wastewater Land Applied Annually (gal)	210,000	340,000	8,000,000	1,040,000
Percent of total liquids land applied annually	2.19	3.55	83.42	10.84

The facility has identified three land application sites (L01-L03) that may be utilized for the land application of wastewater and solids. These three sites total 140 acres and are used to grow Bermuda grass hay around the plant site. The application sites are shown in the following table:

Location of Land Application Sites

Site Designation	Legal Description	Acres Available
L01		90
L02		25 est
L03		25 est

2. Agronomic Cropping

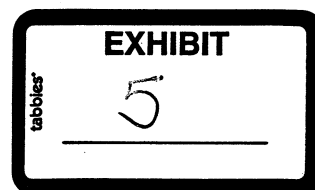
In order to determine the mass loading for nitrogen it is necessary to determine the % plant available nitrogen (%PAN) in the waste to be land applied. The percentage is calculated by using the following formula:

$\%PAN = \%nitrate + VF \times \% ammonia-n + MF \times (\%TKN - \%Nitrate - \%Ammonia-n)^*$ where
VF = the ammonia volatilization factor equals 0.5 for surface spreading
Nitrogen Loading contribution from liquid material:

Constituent percentages are calculated from analytical data for liquids to be land applied included in the permit application.

Based on this information a weighted average composition for liquids is calculated as follows:

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Constituent	095 Trench	005 Trench	Pond 5	Raffinate De-Water	Weighted Average Concentration (mg/l)
TKN	--	--	--	--	0
Ammonia-N	0.021 x 1700	0.0355 x 286	0.8342 x 379	0.1084 x 3490	740
Nitrate-N	--	--	0.8342 x 345	0.1084 x 1620	463

The weight of each constituent from liquids to be land applied is calculated as follows:

weight kg/yr = constituent concentration kg/l x 0.2642 l/gal x volume of liquid to be land applied gal/yr

Constituent	Weighted Average Concentration (mg/l)	conversion factor	Volume of liquid to be land applied	Total Weight of Constituent Land Applied = Column 2 x Column 3 x Column 4 (kg/yr)
TKN	--	0.000003875	9590000	
Nitrate-N	740	0.000003875	9590000	27499
Ammonia-N	463	0.000003875	9590000	17221

The Total weight of all constituents to be land applied is equal to the sum of the solid and liquid contribution and is shown as follows:

Constituent	Total weight of Constituents to be Land Applied (kg)	Percent of Total Nitrogen
TKN	--	--
Nitrate-N	27499	61
Ammonia-N	17221	39

At this point it is necessary to determine what fraction to the total weight of the nitrogen will available for plant growth. The %Plant Available Nitrogen is calculated by the formula shown in Section 3 above and is as follows:

$$\%PAN = \%nitrate + VF \times \% ammonia-n + MF \times (\%TKN - \%Nitrate-N - \%Ammonia-N)$$

Using this formula the amount of plant available nitrogen from the total amount of nitrogen solids to be land applied is calculated as follows:

$$\%PAN = 61 + 0.5 \times (39) + 0.2 \times (0 - 61 - 39)$$

$$\%PAN = 61 + 19.5 - 20 = 60.5 \%$$

For purposes of calculating land application loading rates, the %PAN will be applied to the total weight of Nitrogen available.

As such, nitrogen loading is calculated as follows:

The total weight of nitrogen available for land application is (27,499 + 17,221) = 44,717 kg/yr
Therefore the weight of PAN is 44,717 kg/yr x 0.605 = 27054 kg/yr.

This facility has 140 acres (346 hectares) available for land application. The application rate would then be 44717 kg/yr /346 hectares = 129 kg/hectare/yr or 429 lbs/acre/yr.

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The Facility is using the PAN to grow Bermuda hay which has an maximum annual nitrogen plant uptake rate that ranges from 475 to 600 kg/hectare/yr. The proposed loading rate is well below the maximum uptake rate of the Bermuda grass. The NRC, however, has limited the application rate to 400 lbs/acre. Since the NRC rate is more restrictive than the DEQ projected loading the NCR limit will be used in the permit.

4. Other Specific Requirements for Land Application of Wastewater and Sludge

- a. The hydraulic loading at land application sites L01-L03 shall be maintained to prevent surface runoff of applied wastewater and to prevent persistent flooding (persistent flooding is defined as soil which remains saturated for more than 24 hours). The annual land applied wastewater volume shall not exceed 68,500 gallons per acre per year and shall not exceed 400 pounds of waste solids per acre per year. These limits are set so as not to exceed the nitrogen uptake of Bermuda grass of 400 to 675 kg/ha/yr.
 - b. The nitrogen loading at land application sites L01-L03 shall be maintained to minimize the formation and infiltration of nitrates and nitrate-producing compounds in concentrations that may impact the groundwater.
 - c. Land application of wastewater or sludge shall not occur during periods of precipitation, when the soil is frozen or while the soil is saturated. The wastewater must be stored in the surface impoundments F01-F08 until the soil is capable of receiving wastewater without persistent flooding or surface water runoff. Clarifier Filter Cake shall be stored in a manner that will prevent contamination of stormwater.
 - d. Land application of sludge and wastewater shall not cause permanent vegetative damage or otherwise prevent growth after cessation of application of wastewater.
 - e. Land application sites L01-03 shall be managed to prevent site conditions that have the potential to impact aesthetics, including but not limited to, odors, waste piles, and sludges.
 - f. The land application of wastewater shall not occur within 250 feet of a well used for potable water.
 - g. The land application of sludge or wastewater shall not occur within 100 feet of a stream or body of water and shall not occur within two feet of the highest seasonal water level on a site.
 - h. A 10 foot buffer zone is required between the land application site and the adjacent property boundary. A buffer is not required between adjacent sites.
 - i. The permit may be reopened to implement and/or require land application modifications, additions, extensions, cessation and/or operational changes; additional monitoring and reporting (including but not limited to soil sampling); reclassification of wastes, sludge management plans; best management practices; land application site closure and/or closure plans; remediation and/or remediation plans; monitoring wells and/or subsurface monitoring plans; and/or other appropriate actions.
1. Wastewater Monitoring Requirements
- (1) Each wastestream that contributes wastewater to be land applied shall be tested annually. The Permittee shall collect representative samples of each waste stream and have them analyzed for the following constituents: soil pH and the nutrients – Total Kjeldahl Nitrogen (TKN), nitrogen (N), ammonia (NH_4)-N, nitrate (NO_3)-N, potassium (K) and phosphorus (P).

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- (2). Based on the results of the tests, the annual nitrogen loading rate may be adjusted to insure the plant uptake is not exceeded.

m. Soil Monitoring Requirements

- (1) Soil sampling

Soil samples shall consist of a composite sample taken from sites proposed or used for the land application of sludge and wastewater. Soil testing procedures applicable for use in the local area in accordance with Oklahoma State University soil testing guidance or the local NRCS may be used. Sampling of proposed land application sites is required to determine the background concentration of constituents to be land applied for disposal.

- (2) Soil monitoring.

Each land application site that receives solids, sludge or wastewater shall be tested annually to determine the residual nitrogen content. The Permittee shall collect representative soil samples from each land application site that received waste or wastewater and have them analyzed for the following constituents: soil pH and the nutrients – Total Kjeldahl Nitrogen (TKN), nitrogen (N), ammonia (NH₄)-N, nitrate (NO₃)-N, potassium (K) and phosphorus (P).

- (3). Based on the results of the soil tests, the annual nitrogen loading rate may be adjusted to insure the plant uptake is not exceeded.

5. Record keeping and Reporting Requirements

- (a). Records. Maintain the following land application records:

- (1) location, day and hour land application began and ended, and the method of application;
- (2) analytical data, volume and source(s) of wastewater applied;
- (3) loading rates;
- (4) weather conditions during the application period;
- (5) type of crop, grass or vegetation grown on site;
- (6) pH of wastewater at beginning of application, or weekly if application exceeds seven consecutive days; and
- (7) monitoring records, including the date, time and exact place of the sampling or measurement, the name of the sampler, when analysis began, the name of the certified laboratory and the analytical results.

- (b) Reporting requirements:

- (1) The owner or operator shall submit reports of monitoring and land application records by month on a quarterly basis unless otherwise specified.
- (2) The quarterly reports will be due on or before the last working day of the month following the close of each quarter (i.e., April, July, October and January).
- (3) Monitoring information shall be submitted to the DEQ on self-monitoring report (SMR) forms or other forms provided or approved by the DEQ.